(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 699 842 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
10.05.2000 Bulletin 2000/19

(51) Int Cl.[7]: **F16C 13/00**, F16C 43/08

(21) Application number: **95110966.9**

(22) Date of filing: **13.07.1995**

(54) **Ball bearing block having self-contained bearings**

Kugellagerblock mit selbsthaltenden Lagern

Poulie à roulement à billes avec des paliers à auto-rétention

(84) Designated Contracting States:
DE FR GB IT NL SE

(30) Priority: **29.08.1994 US 297485**

(43) Date of publication of application:
06.03.1996 Bulletin 1996/10

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EP 0 699 842 B1

Printed by Jouve, 75001 PARIS (FR)

Description

Background of the Invention

[0001] The present invention relates to a bearing block or sheave in which a pair of circular rows of bearing balls are disposed between relatively rotatable inner and outer races.

[0002] Bearing blocks or pulleys are widely used on sailing craft to control and change the direction of lines, to provide a mechanical advantage, or otherwise adjust the rigging.

[0003] With the introduction of small diameter, high strength lines, the sailing industry has developed the need for very small blocks or pulleys. The small diameter line is usually connected to a larger diameter line to facilitate hand operation beyond the pulleys. The lines are used to control various parts of the sailboat rigging without undue clutter. Blocks of this nature have outer sheaves with a diameter down to 16 mm or less.

[0004] When dealing with so-called micro blocks, assembly of a number of small parts becomes a problem, but the use of rotary bearings, such as bearing balls is highly desirable, in order to reduce friction around a very small turning radius. Desirably, the block should be light in weight, have high load handling capacity for its size, and utilize bearings to reduce friction.

[0005] EP-A-0 192 841 discloses a ball bearing for accomodating radial and thrust loads with a hub, an outer ring defining the outer race and bearing balls between the two. This bearing comprises a radial protrusion between the two rows of balls preventing the axial displacement of the hub. The outer sleeve comprises two outer shoulders preventing its axial displacement, the outer sleeve being composed of two parts.

Summary of Invention

[0006] In accordance with the present invention, the main operating components of the bearing block consists solely of a hub having a pair of inner bearing races, an outer rotatable sheave having a pair of outer races, and a plurality of bearing balls snap-fitted between the corresponding pairs of inner and outer races.

[0007] The hub is generally cylindrical having ends, and a pair of circular grooves are formed in the hub closely adjacent the ends. The grooves define a pair of inner ball bearing races and also define an outer lip which later serves to retain the balls in the final assembly.

[0008] The outer rotatable sheave is generally ring-shaped and has a pair of ring-shaped recesses or shoulders which are open to interior and the sides. These recesses define a pair of outer bearing races concentric with the inner races, and a pair of thrust bearing races for the sheave, to prevent axial displacement of the sheave.

[0009] After the sheave is positioned around the hub, a plurality of ball bearings are inserted from the sides, and are snap fitted over the lip on the inner race and into operative position between the inner and outer races. The bearings carry the radial and axial or thrust loads. the grooves and corresponding lips prevent the bearings from being displaced axially.

[0010] It may seem that the number of parts, in comparison to a conventional block, is greatly reduced, and assembly of block to provide a self-contained lightweight unit, is greatly simplified.

Brief Description of the Drawings

[0011] Figure 1 is a perspective view of the bearing block of the present invention.

[0012] Figure 2 is an end view of the block shown in Figure 1, with the outer sheave shown in cross section.

[0013] Figure 3 is a sectional view of the outer sheave shown in Figures 1 and 2, taken through the axis.

[0014] Figure 4 is a perspective view of the inner race.

[0015] Figure 5 is an axial sectional view of the inner race.

[0016] Figure 6 is a perspective view of a bail or cheek which may be employed to support the block shown in Figure 1.

Description of the Preferred Embodiments

[0017] Figures 1 and 2 illustrate the bearing block of the present invention. The block comprises an outer rotatable sheave 10, which has an outer circumferential U-shaped groove 12 or depression to guide a line which may be reeved thereon. The assembly also includes an inner hub 14 and two rows of ball bearings 16 and 18 carried between inner races in the hub and corresponding circular bearing surfaces on the outer sheave 10.

[0018] As shown in figures 2, 4 and 5, the central hub 14 is generally cylindrical, in the form of a tube or post, and has a pair of spaced outwardly facing circular grooves 20 and 22 therein, which serve as inner bearing races. The grooves 20 and 22 are closely adjacent the annular sides 24 of the hub 14 and define an annular lip 26 between the grooves and the ends. The grooves 20 and 22 have a cross sectional radius which is arcuate and slightly larger in radius than the ball bearings used in the assembly. The hub 14 is normally considered as the stationary part of the assembly and is either held between side plates 16 attached to a head, for attachment to a support, or the hub itself is fixed to a support.

[0019] The sheave, as best shown in Figures 2 and 3, is generally ring-shaped, with a central opening 28 and side surfaces 30. Annular or ring-shaped recesses or concave open annular shoulders are provided in each side of the sheave, with the recesses being open inwardly onto the sides. These recesses define circular or cylindrical concave surfaces 32 and 34, which serve as outer bearing races concentric with the inner races, and inner annular surfaces 36 and 38 extending inwardly

from the concave walls toward the axis preferably with a curved radius between the walls. The annular surfaces 36 and 38 serve as thrust bearing surfaces. The surfaces 32 and 34 may be grooved raceways if desired.

[0020] The groups of ball bearings are made from a metal such as steel, or from a plastic bearing material. The diameter of the bearings 16 and 18 is sufficient to rotatably support the outer sheave 10 about an axis of rotation, with the bearings riding in the rounded grooves 22 and 24 and against the outer races 32 and 34 and thrust races 36 and 38 of the sheave. For small diameter blocks, the hub and ball bearings are preferably composed of high strength materials such as stainless steel.

[0021] To enable retention of the bearings, the diameter of the balls is slightly greater than the distance between each annular lip 26 on the inner race and the opposed and overlapping outer races 32 and 34 when the parts are in concentric relationship. The ball bearings are inserted into the recesses of the sheave and are snap-fitted over the lips to complete the assembly. To facilitate this procedure, one or more of the parts may be made from a material which is softer or more flexible than the other parts. For example, if the central hub and bearings are made from steel, the sheave 10 may be composed of a reinforced plastic. Plastic bearings may be employed if the hub and sheave are made of metal.

[0022] In a typical assembly procedure, the outer sheave 10 is disposed around the hub 14 and the parts are displaced radially to provide a large opening at one side, and most of the bearings 16 may be simply poured or dropped into the opening very quickly, with the last few balls being snap-fitted into place. As a result, assembly time is greatly reduced.

[0023] It may be seen from Figure 1 that, in the final assembly, the ball bearings 16 are entirely exposed to the side except around the lips 26, which serve to permanently retain the balls in the assembly. This permits inspection, cleaning and lubrication of the bearings.

[0024] Figure 6 illustrates a conventional bail or strap to enable mounting or hanging of the sheave assembly. The strap comprises a U-shaped strap having an attachment head 50 integral with a pair of side plates 52 and 54 having openings 56 for receiving a pin or rivet (not shown) to secure the inner race 14 between the side plates while the sheave 10 is free to rotate.

[0025] The bearing block of the present invention has several advantages over similar blocks currently in use. The inner raceways, in the form of circular arcs, prevent point contact with the balls and allow the load to be transferred to the hub along circular arcs. this is very important, especially in very small blocks having small diameter inner races operating at high loads.

[0026] The block of the present invention has an additional advantage in that it is self-contained and may be easily handled. The ball bearings also act as thrust bearings and act against an inner surface of the sheave rather than an outer surface. Due to the recesses in the sides of the sheave, the mass of the sheave is reduced, allowing for more rapid acceleration.

[0027] As an example of the block of the present invention, a block with a 16 mm (5/8 inch) diameter sheave on an inner race of about .3 inch in diameter has a weight of 8 g or 1/3 oz. and 113 kg or 250 pound free rolling load.

Claims

1. A bearing block comprising a central hub (14) having ends, a pair of circular grooves (20,22) in said hub (14) near respective ends of said hub (14), said circular grooves (20,12) defining a pair of spaced inner bearing races around a central axis and bearing retaining lips (26) between said grooves and respective ends, a sheave (10) disposed around said hub (14), said sheave being generally ring shaped and having annular sides and an inner diameter, and a pair of ring-shaped annular recesses (32, 34) in the sides of said sheave (10), said recesses (32,34) being open to the sides and the inner diameter of the sheave (10) and defining a pair of circular outer bearing races concentric with respective inner races, and inner annular surfaces (36,38) extending inwardly from the ring-shaped annular recesses (32,34), toward the axis, said inner annular surfaces (36,38) serving as thrust bearing surfaces, and a plurality of bearing balls (16,18) in bearing engagement between said inner and outer races, said bearing retaining lips retaining said bearing balls (16,18) and preventing axial displacement thereof.

2. The bearing block of claim 1 wherein said ring-shaped annular recesses (32,34) in said sheave (10) define respective annular walls on an angle to said outer bearing races, said bearing balls (16,18) being in bearing engagement with said annular walls and preventing axial displacement of said sheave (10) relative to said hub.

3. The bearing block of claim 1 wherein said bearing balls (16,18) are snap-fitted into said bearing engagement between said lips (26) and said outer bearing races.

4. The bearing block of claim 1 wherein said outer bearing races are concave cylindrical surfaces, and the bearing balls (16,18) of said block are entirely exposed to the sides thereof except at said lips (26).

5. The bearing block of claim 1 wherein said circular grooves are arcuate in cross section and substantially conform to the radius of the bearing balls (16,18).

6. The bearing block of claim 5 wherein said outer bearing races in said sheave (10) are concave cy-

lindrical surfaces.

7. The bearing block of claim 1 additionally comprising means for attaching said central hub to a support.

8. The bearing block of claim 1 wherein said central hub (14) and said bearing balls (16,18) are composed of steel.

Patentansprüche

1. Lagerblock mit einer zentralen Nabe (14) mit Enden, zwei ringförmigen Nuten (20, 22) in der Nabe (14) nahe den jeweiligen Enden der Nabe (14), wobei die kreisförmigen Nuten (20, 12) zwei beabstandete innere Lagerlaufbahnen um eine zentrale Achse bilden, und Lagerhaltelippen (26) zwischen den Nuten und den jeweiligen Enden, mit einer Scheibe (10), die um die Nabe herum (14) angeordnet ist und allgemein eine Ringform hat mit ringförmigen Seiten und einem Innendurchmesser, zwei ringförmigen kreisförmigen Aussparungen (32, 34) in den Seiten der Scheibe (10), wobei die Aussparungen (32, 34) offen zu den Seiten und zu dem Innendurchmesser der Scheibe (10) sind und zwei kreisförmige äußere Lagerlaufbahnen bilden, die konzentrisch zu den jeweiligen inneren Laufbahnen verlaufen, wobei die inneren kreisförmigen Flächen (36, 38) sich von den ringförmigen kreisförmigen Aussparungen (32, 34) nach innen in Richtung der Achse erstrecken und die inneren ringförmigen Flächen (36, 38) als Axiallastlagerflächen dienen, und mit mehreren Lagerkugeln (16, 18), die im Lagereingriff zwischen den inneren und den äußeren Laufbahnen stehen, wobei die Lagerhaltelippen die Lagerkugeln (16, 18) halten und ihre axiale Verlagerung verhindern.

2. Lagerblock nach Anspruch 1,
wobei die ringförmigen kreisförmigen Aussparungen (32, 34) in der Scheibe (10) ringförmige Wände in einem Winkel zu den äußeren Lagerlaufbahnen bilden, wobei die Lagerkugeln (16, 18) im Lagereingriff mit den ringförmigen Wänden stehen und eine axiale Verlagerung der Scheibe (10) relativ zu der Nabe verhindert.

3. Lagerblock nach Anspruch 1,
wobei die Lagerkugeln (16, 18) in den Lagereingriff zwischen den Lippen (26) und den äußeren Lagerlaufbahnen eingerastet sind.

4. Lagerblock nach Anspruch 1,
wobei die äußeren Lagerlaufbahnen konkave zylindrische Flächen sind und die Lagerkugeln (16, 18) des Blocks vollständig zu dessen Seiten freiliegen mit Ausnahme an den Lippen (26).

5. Lagerblock nach Anspruch 1,
wobei die kreisförmigen Nuten einen gewölbten Querschnitt haben und im wesentlichen mit dem Radius der Lagerkugeln (16, 18) übereinstimmen.

6. Lagerblock nach Anspruch 5,
wobei die äußeren Lagerflächen in der Scheibe (10) konkave zylindrische Flächen sind.

7. Lagerblock nach Anspruch 1,
ferner enthaltend eine Einrichtung zur Befestigung der zentralen Nabe an einer Halterung.

8. Lagerblock nach Anspruch 1,
wobei die zentrale Nabe (14) und die Lagerkugeln (16, 18) aus Stahl bestehen.

Revendications

1. Une poulie à roulement comprenant un moyeu central (14) présentant des extrémités, une paire de gorges circulaires (20, 22) dans ledit moyeu (14) à proximité des extrémités respectives dudit moyeu (14), lesdites gorges circulaires (20, 22) définissant, autour d'un axe central, une paire de chemins de roulement interne espacés et des lèvres de retenue de roulement (26) entre lesdites gorges et extrémités respectives, un réa (10) disposé autour dudit moyeu (14), ledit réa ayant de manière générale la forme d'un anneau et présentant des côtés annulaires et un diamètre interne, et une paire d'évidements annulaires en forme d'anneau (32, 34) dans les côtés dudit réa (10), lesdits évidements (32, 34) étant ouverts vers les côtés et le diamètre interne du réa (10) et définissant une paire de chemins de roulement externes circulaires concentriques aux chemins de roulement internes respectifs, et des surfaces annulaires internes (36, 38) s'étendant vers l'intérieur à partir des évidements annulaires en forme d'anneau (32, 34), vers l'axe, lesdites surfaces annulaires internes (36, 38) servant de surface de butée de roulement, et une pluralité de billes de roulement (16, 18) en engagement de roulement entre lesdits chemins de roulement interne et externe, lesdites lèvres de retenue de roulement retenant lesdites billes de roulement (16, 18) et empêchant un déplacement axial de celles-ci.

2. La poulie à roulement de la revendication 1 dans laquelle lesdits évidements annulaires en forme d'anneau (32, 34) prévus dans ledit réa (10) définissent des parois annulaires respectives sur un angle par rapport auxdits chemins de roulement externes, lesdites billes de roulement (16, 18) étant en engagement de roulement avec lesdites parois annulaires et empêchant un déplacement axial dudit réa (10) par rapport audit moyeu.

3. La poulie à roulement de la revendication 1 dans laquelle lesdites billes de roulement (16, 18) sont montées par encliquetage dans ledit engagement de roulement entre lesdites lèvres (26) et lesdits chemins de roulement externes.

4. La poulie à roulement de la revendication 1 dans laquelle lesdits chemins de roulement externes sont des surfaces cylindriques concaves, et les côtés des billes de roulement (16, 18) de ladite poulie sont entièrement exposées sauf au niveau desdites lèvres (26).

5. La poulie à roulement de la revendication 1 dans laquelle lesdites gorges circulaires sont de section transversale arrondie et se conforment sensiblement au rayon des billes de roulement (16, 18).

6. La poulie à roulement de la revendication 5 dans laquelle lesdits chemins de roulement externes desdits réas (10) sont des surfaces cylindriques concaves.

7. La poulie à roulement de la revendication 1 comprenant supplémentairement des moyens pour fixer ledit moyeu central à un support.

8. La poulie à roulement de la revendication 1 dans laquelle ledit moyeu central (14) et lesdites billes de roulement (16, 18) sont réalisées en acier.

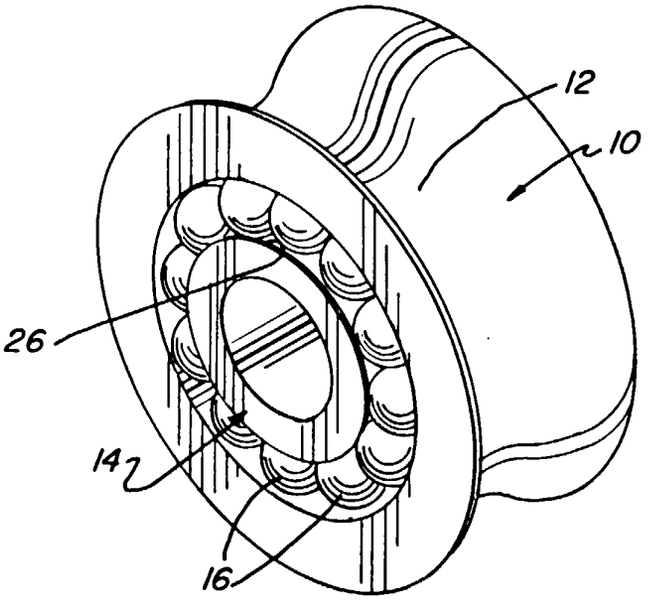

FIG. 1

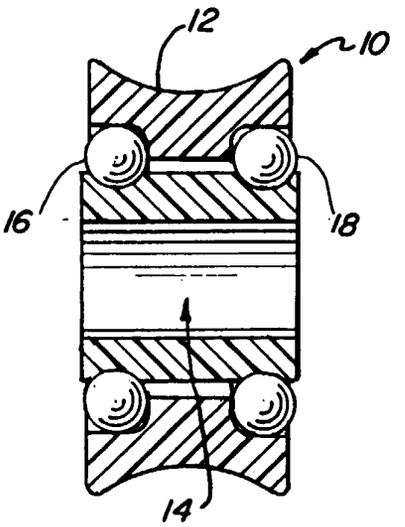

FIG.2

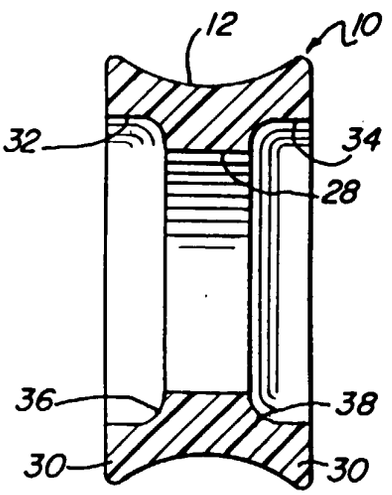

FIG.3

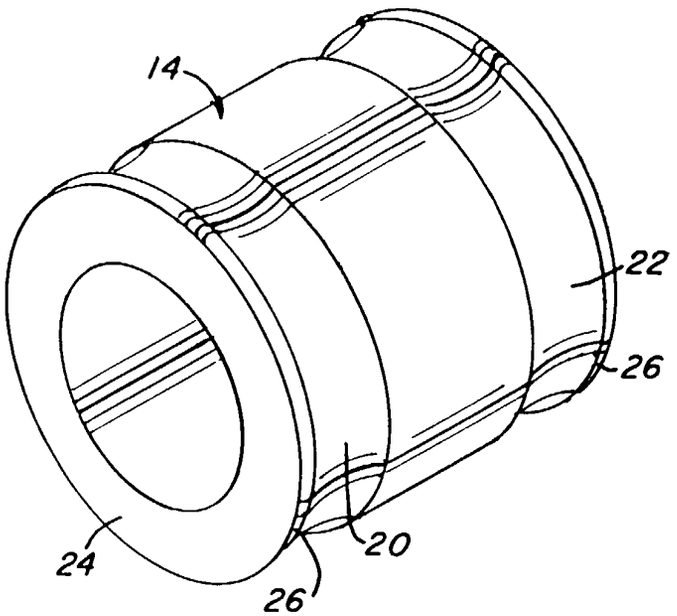

FIG. 4

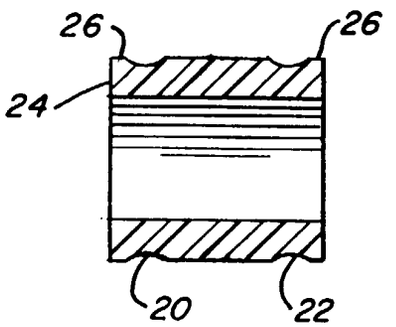

FIG. 5

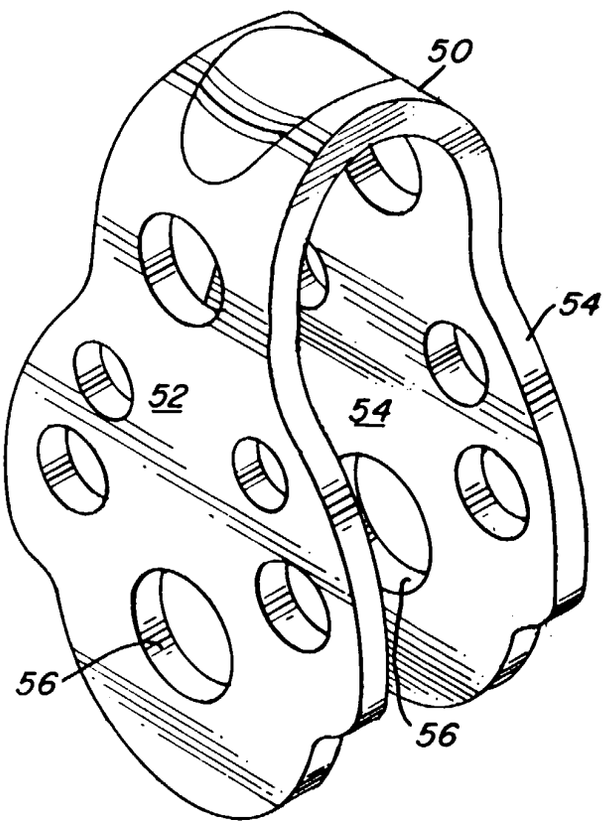

FIG. 6